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AD-A034 731

REPORT ON THE GEOPHYSICAL DESCRIPTION AND
AVAILABLE DATA ASSOCIATED WITH ROCKET
PF-NH-89 (IC 507.11-2A)

ALASKA UNIVERSITY, COLLEGE, ALASKA

JANUARY 1976

010067

ADA034733

NRRL-
ANCL-TR-76-0010

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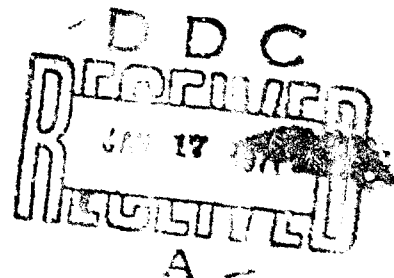
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January 1976

Scientific Report No. 6

HAES Report No. 54



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This research was sponsored by the Defense Nuclear Agency under Subtask
L25AAXYX966, Work Unit 16, entitled "Analysis and Feasibility Assessment".

AIR FORCE GEOPHYSICS LABORATORY
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
HANSCOM AFB, MASSACHUSETTS 01731

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFRL-TR-76-0010	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) REPORT ON THE GEOPHYSICAL DESCRIPTION AND AVAILABLE DATA ASSOCIATED WITH ROCKET PF-NH-89 (IC 507.11-2A)		5. TYPE OF REPORT & PERIOD COVERED Scientific-Interim
7. AUTHOR(s) Gerald J. Romick		6. PERFORMING ORG. REPORT NUMBER Scientific Report No. 6
9. PERFORMING ORGANIZATION NAME AND ADDRESS Geophysical Institute University of Alaska Fairbanks, Alaska 99701		8. CONTRACT OR GRANT NUMBER(s) F19628-74-C-0188 HAES Report No. 54
11. CONTROLLING OFFICE NAME AND ADDRESS Air Force Geophysics Laboratory Hanscom AFB, Massachusetts 01731 Contract Monitor: Richard M. Nadile/OPR		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS CDNA-00-18
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE January 1976
		13. NUMBER OF PAGES 40
		15. SECURITY CLASS. (of this report) Unclassified
		16a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES This research was sponsored by the Defense Nuclear Agency under Subtask L25AAXYX966, Work Unit 16, entitled "Analysis and Feasibility Assessment"		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Geophysical parameters, ground station observations, aurora, meteorology, sun, moon, magnetic, photometer, All Sky camera, riometer, ionosonde, television, radar, look angles		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A Nike-Hydrac rocket was launched at 09:12:20 UT on March 10, 1975 from Poker Flat Research Rocket Range. This rocket reached an apogee altitude of 152 km with a total flight time greater than 454 seconds. The payload was success- fully recovered. The rocket was launched during an intense auroral substorm (-600γ in ΔH) into a westward traveling surge. The sky at Ester Dome and Ft. Yukon was clear. No meridian scanning photometer data were recorded at either Ft. Yukon or Ester Dome due to camera malfunction. However, analysis of the		

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20. ground ASC data recorded at Ester Dome and Ft. Yukon can be used to assist in determining the relationship of the on-board data to the aurora.

11 Unclassified

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Summary

The PF-NH-89 rocket launched 09:12:20 U March 10, 1975, entered a very active auroral display. The region traversed by the rocket was the central intense region of a westward traveling surge. The magnetic activity at College was -600γ in ΔH initially, becoming less intense during launch; however, the Ft. Yukon magnetic activity increased from -350γ to -950γ over the same period. Absorption associated with this region which moved westward and poleward reached 5 db. Unfortunately, no photometric data were obtained at either Ft. Yukon or Ester Dome. However, all-sky camera data can be used to describe the activity associated with this launch.

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OGC	Off Section <input type="checkbox"/>
UNAN: OUNCES	<input type="checkbox"/>
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PREFACE

The High Altitude Effects Simulation (HAES) Program sponsored by the Defense Nuclear Agency since the early 1970 time period, comprises several groupings of separate, but interrelated technical activities, e.g., ICECAP (Infrared Chemistry Experiments--Coordinated Auroral Program). Each of the latter have the common objective of providing information ascertained as essential for the development and validation of predictive computer codes designed for use with high priority DoD radar, communications, and optical defensive systems.

Since the inception of the HAES Program, significant achievements and results have been described in reports published by DNA, participating service laboratories, and supportive organizations. In order to provide greater visibility for such information and enhance its timely applications, significant reports published since early calendar 1974 shall be identified with an assigned HAES serial number and the appropriate activity acronym (e.g., ICECAP) as part of the report title. A complete and current bibliography of all HAES reports issued prior to and subsequent to HAES Report No. 1 dated 5 February 1974 entitled, "Rocket Launch of an SWIR Spectrometer into an Aurora (ICECAP 72)," AFCRL Environmental Research Paper No. 466, is maintained and available on request at DASIAC, DoD Nuclear Information and Analysis Center, 816 State Street, Santa Barbara, California 93102, Telephone: (805) 965-0551.

This report, which is the sixth report under DNA Contract F19628-74-C-0188 is the 54th report in the HAES series and covers technical activities performed during the period November 1975 through January

1976. The purpose of the work herein is to provide a geophysical description of the auroral and geomagnetic environment during the launch of ICECAP rocket PF-NH-89 (IC 507.11-2A); to assist in interpretation of the primary measurements obtained by the sensors onboard this specific experimental payload.

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INTRODUCTION

This report describes the general auroral activity associated with the launch of rocket PF-NH-89 on UT March 10, 1975 at Poker Flat Research Range. Included in this report are peripheral data pertinent to the launch, atmospheric meteorology and ground station instrumentation operation.

The format is arranged in sections to facilitate locating specific information on the various types of data and instruments that were in operation. Explanatory material is included with each section for completeness.

The summary that is presented pertains only to the description of the geomagnetic activity and our evaluation of the usefulness in proceeding to detailed absolute intensity and high time resolution studies of the available ground based data.

Section 1 - Launch Parameters

This section reviews all of the pertinent details known at the time of the preparation of this report on the launch parameters of the vehicle. The specific details of the launch are listed in Table 1.

TABLE 1 Launch Resume

Vehicle Type-----	Nike-Hydac
Poker Flat Research Range Vehicle Code Number----	PF-NH-89
NASA or other Vehicle Code Number-----	IC507.11-2A
Launch Date and Time-----	UT March 10, 1975 09:12:20.04
Launch Azimuth	predicted, (actual setting) 45, (23.1)
QE	predicted, (actual setting) 83.5, (84.1)
Apogee Altitude	predicted, (actual) 147 km, (152 km)
Apogee Time	predicted, (actual) (200 sec)
Impact Range	predicted, (actual) 110 km, (112.1 km)
Impact Azimuth	predicted, (actual) 45, (35.84)
Impact Time	predicted, (actual) (454 sec) recovery payload
Payload Weight-----	284 lbs.

Table 2 lists the rocket and field line observation angles obtained from the trajectory supplied by Space Data Corporation. Listed in 10 second steps in time after the launch (T+0) are the Azimuth and Elevation angles to the vehicle and to the 100 km intercept point along the field line through the rocket as seen from Poker Flat, Ft. Yukon and Ester Dome. The magnetic field model used in this calculation is the Pogo 10-65 internal field model. The altitude of the rocket is also listed.

LOOK ANGLE DATA

ROCKET OBSERVATION ANGLES 100 FT. FIELD LINE INTERCEPT OBSERVATION ANGLES

(sec)	ESTER DOME				FOKER FLATS				FT. YUKON				ESTER DOME				FOKER FLATS				FT. YUKON				(ALT)
	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH	ELEVATION	AZIMUTH			
190	20.7512	12.3601	76.2555	35.1456	29.0222	248.9761	33.4979	11.4039	47.6414	46.7193	41.9442	24.2761	55.57												
200	23.6729	12.7207	77.6506	34.1042	35.0673	250.1432	32.4904	12.1277	84.1121	35.5889	43.1097	24.3177	72.70												
210	26.6446	13.1117	77.2329	23.8653	40.5803	251.2312	31.5107	12.7501	84.9497	34.7866	44.6240	25.0366	64.45												
220	29.6165	13.5021	76.5899	35.5148	44.0574	251.0193	30.7403	13.3731	74.1411	35.7866	45.9026	25.1506	59.44												
230	31.5385	13.8926	76.3421	34.1188	48.4175	251.4540	29.8435	13.9433	75.0657	31.0910	47.2055	25.3412	100.28												
240	32.5501	14.2578	75.5501	33.5472	51.5201	251.821	29.1253	14.5049	75.2072	33.5327	48.4905	25.6130	114.15												
250	34.4573	14.6268	75.4325	35.1647	54.1677	252.1343	28.5833	15.1519	75.3453	34.0450	49.7265	25.7605	123.12												
260	35.3525	14.9465	74.6515	34.1051	56.7416	252.355	27.9669	15.6916	67.5401	33.0164	50.7351	25.9407	125.76												
270	36.0587	15.2540	73.5203	34.0412	58.3312	252.529	27.2554	16.1612	67.7114	33.0302	51.9157	26.104	134.37												
280	36.6259	15.5517	73.27717	35.5352	59.9737	252.6413	26.8097	16.5113	61.4733	34.0797	53.1749	26.2704	140.67												
290	36.9524	15.8112	72.6003	34.1122	61.3752	252.703	26.4030	16.8416	53.7455	33.2430	54.7335	26.4201	144.33												
300	37.1450	16.1515	71.8155	34.0567	62.5761	252.761	25.5555	17.1713	53.6805	34.0170	55.7210	26.5175	150.37												
310	37.4232	16.7465	71.4101	35.5507	63.7232	252.801	25.5555	17.5015	53.6805	33.7404	56.4321	26.6415	151.65												
320	37.6127	16.8882	70.1419	34.1452	64.5344	252.832	24.6477	17.8312	53.6805	33.7404	56.4321	26.7415	152.70												
330	37.8144	16.9550	68.6502	34.0502	65.0914	252.852	24.6477	18.1611	53.6805	33.7404	56.4321	26.8415	153.70												
340	38.0144	17.0002	68.2709	35.4908	65.5922	252.862	24.6477	18.4911	53.6805	33.7404	56.4321	26.9415	154.70												
350	38.2144	17.0322	66.7205	34.2145	66.0326	252.872	24.6477	18.8211	53.6805	33.7404	56.4321	27.0415	155.70												
360	38.4144	17.0642	65.4206	34.5157	66.3390	252.882	24.6477	19.1511	53.6805	33.7404	56.4321	27.1415	156.70												
370	38.6144	17.0962	64.5192	35.4150	66.6395	252.892	24.6477	19.4811	53.6805	33.7404	56.4321	27.2415	157.70												
380	38.8144	17.1282	64.0127	34.7127	66.3460	252.902	24.6477	19.8111	53.6805	33.7404	56.4321	27.3415	158.70												
390	39.0144	17.1602	63.2607	34.6503	66.0353	252.912	24.6477	20.1411	53.6805	33.7404	56.4321	27.4415	159.70												
400	39.2144	17.1922	62.3113	34.6502	66.0353	252.922	24.6477	20.4711	53.6805	33.7404	56.4321	27.5415	160.70												
410	39.4144	17.2242	58.2800	35.4001	65.8243	252.932	24.6477	20.8011	53.6805	33.7404	56.4321	27.6415	161.70												
420	39.6144	17.2562	55.5178	35.3720	65.0534	252.942	24.6477	21.1311	53.6805	33.7404	56.4321	27.7415	162.70												
430	39.8144	17.2882	54.5101	34.6614	63.6274	252.952	24.6477	21.4611	53.6805	33.7404	56.4321	27.8415	163.70												
440	39.9579	15.6979	45.7317	35.2505	62.3812	255.5179	22.5401	19.7460	47.6479	35.1112	61.0123	205.7913	166.17												
450	40.5300	15.5833	45.6505	35.4315	60.4630	290.9124	22.4259	19.9540	47.2629	35.4832	61.3173	209.1134	50.28												
460	41.5170	20.2016	41.3517	35.4193	57.5843	302.6343	22.3081	20.3885	46.8423	35.6060	61.5181	209.4797	85.25												
470	16.1469	20.2876	36.4663	35.4182	53.6563	305.8681	22.2452	20.1907	46.6083	35.7451	61.6545	330.7470	75.80												
480	13.0915	20.5782	30.4688	35.3810	46.4926	307.5305	22.1705	20.2905	46.3355	35.8573	61.7956	331.1446	60.54												
490	5.6158	20.7540	24.1027	35.2707	41.4942	312.8155	22.1319	20.3768	46.1892	35.9974	61.9244	331.6455	47.68												
500	6.6456	20.6257	16.9353	35.3613	21.6474	316.3400	22.0867	20.4707	46.0148	36.1437	62.0503	332.2242	32.53												
510	4.1556	21.0723	11.4557	35.3715	22.0725	318.7354	22.0725	20.5356	45.9489	36.2728	62.1603	332.4347	23.43												

TABLE 2 Look Angle Data

Section 2 - Meteorological Data

The weather summaries are given in Table 3. The data are obtained from either station logs, ASC data, or weather bureau records. Also included in Table 4 (next page) are the complete 3 hour climatology data for the month of March at the U. S. Weather Bureau Station at the Fairbanks International Airport.

TABLE 3 Weather Summary March 10, 1975

Time (UT)	Ester Dome	Poker Flat	Ft. Yukon	Mould Bay	Sachs Harbor	Inuvik
05	Clear	Clear	Clear	Clear		Clear
06	Clear	Clear	Clear	Clear	NO	Clear
07	Clear	Clear	Clear	Clear	DATA	Clear
08	Clear	Clear	Clear	Clear	FOR	Clear
09	Clear	Clear	Clear	Clear	THIS	Clear
10	Clear	Clear	Clear	Clear	TIME	Clear
11	Clear	Clear	Clear	Clear		Clear
12	Clear	Clear	Clear	Clear		Clear

Table 5 gives the wind parameters at Poker Flat at the time of launch.

TABLE 5 Wind Data at Launch

Surface Wind Velocity	3.4 m/s	Az 146.2°
Ballistic Wind Velocity	6.1 m/s	Az 111.2

OBSERVATIONS AT 3-HOUR INTERVALS

DAY 01										DAY 02										DAY 03										
02	0	0	0	0	0	0	0	0	0	02	01	-10	57	00	0	0	0	0	0	0	02	01	-17	51	00	0	0	0	0	0
05	0	0	0	0	0	0	0	0	0	05	01	-09	57	00	0	0	0	0	0	0	05	01	-09	50	01	0	0	0	0	0
08	0	0	0	0	0	0	0	0	0	08	01	-08	57	00	0	0	0	0	0	0	08	01	-07	50	01	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	11	01	-07	57	00	0	0	0	0	0	0	11	01	-06	50	01	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	14	01	-06	57	00	0	0	0	0	0	0	14	01	-05	50	01	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	17	01	-05	57	00	0	0	0	0	0	0	17	01	-04	50	01	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	20	01	-04	57	00	0	0	0	0	0	0	20	01	-03	50	01	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	23	01	-03	57	00	0	0	0	0	0	0	23	01	-02	50	01	0	0	0	0	0
DAY 04										DAY 05										DAY 06										
02	0	0	0	0	0	0	0	0	0	02	01	-12	54	06	3	10	50	3	1	02	01	-12	54	06	3	10	50	3	1	
05	0	0	0	0	0	0	0	0	0	05	01	-11	54	06	3	10	50	3	1	05	01	-11	54	06	3	10	50	3	1	
08	0	0	0	0	0	0	0	0	0	08	01	-10	54	06	3	10	50	3	1	08	01	-10	54	06	3	10	50	3	1	
11	0	0	0	0	0	0	0	0	0	11	01	-09	54	06	3	10	50	3	1	11	01	-09	54	06	3	10	50	3	1	
14	0	0	0	0	0	0	0	0	0	14	01	-08	54	06	3	10	50	3	1	14	01	-08	54	06	3	10	50	3	1	
17	0	0	0	0	0	0	0	0	0	17	01	-07	54	06	3	10	50	3	1	17	01	-07	54	06	3	10	50	3	1	
20	0	0	0	0	0	0	0	0	0	20	01	-06	54	06	3	10	50	3	1	20	01	-06	54	06	3	10	50	3	1	
23	0	0	0	0	0	0	0	0	0	23	01	-05	54	06	3	10	50	3	1	23	01	-05	54	06	3	10	50	3	1	
DAY 07										DAY 08										DAY 09										
02	0	0	0	0	0	0	0	0	0	02	01	-10	52	06	6	0	0	0	0	0	02	01	-10	52	06	6	0	0	0	0
05	0	0	0	0	0	0	0	0	0	05	01	-09	52	06	6	0	0	0	0	0	05	01	-09	52	06	6	0	0	0	0
08	0	0	0	0	0	0	0	0	0	08	01	-08	52	06	6	0	0	0	0	0	08	01	-08	52	06	6	0	0	0	0
11	0	0	0	0	0	0	0	0	0	11	01	-07	52	06	6	0	0	0	0	0	11	01	-07	52	06	6	0	0	0	0
14	0	0	0	0	0	0	0	0	0	14	01	-06	52	06	6	0	0	0	0	0	14	01	-06	52	06	6	0	0	0	0
17	0	0	0	0	0	0	0	0	0	17	01	-05	52	06	6	0	0	0	0	0	17	01	-05	52	06	6	0	0	0	0
20	0	0	0	0	0	0	0	0	0	20	01	-04	52	06	6	0	0	0	0	0	20	01	-04	52	06	6	0	0	0	0
23	0	0	0	0	0	0	0	0	0	23	01	-03	52	06	6	0	0	0	0	0	23	01	-03	52	06	6	0	0	0	0
DAY 10										DAY 11										DAY 12										
02	0	0	0	0	0	0	0	0	0	02	01	-12	51	32	3	4	00	15	1	02	01	-12	51	32	3	4	00	15	1	
05	0	0	0	0	0	0	0	0	0	05	01	-11	51	32	3	4	00	15	1	05	01	-11	51	32	3	4	00	15	1	
08	0	0	0	0	0	0	0	0	0	08	01	-10	51	32	3	4	00	15	1	08	01	-10	51	32	3	4	00	15	1	
11	0	0	0	0	0	0	0	0	0	11	01	-09	51	32	3	4	00	15	1	11	01	-09	51	32	3	4	00	15	1	
14	0	0	0	0	0	0	0	0	0	14	01	-08	51	32	3	4	00	15	1	14	01	-08	51	32	3	4	00	15	1	
17	0	0	0	0	0	0	0	0	0	17	01	-07	51	32	3	4	00	15	1	17	01	-07	51	32	3	4	00	15	1	
20	0	0	0	0	0	0	0	0	0	20	01	-06	51	32	3	4	00	15	1	20	01	-06	51	32	3	4	00	15	1	
23	0	0	0	0	0	0	0	0	0	23	01	-05	51	32	3	4	00	15	1	23	01	-05	51	32	3	4	00	15	1	
DAY 13										DAY 14										DAY 15										
02	0	0	0	0	0	0	0	0	0	02	01	-10	54	33	3	0	0	0	0	0	02	01	-10	54	33	3	0	0	0	0
05	0	0	0	0	0	0	0	0	0	05	01	-09	54	33	3	0	0	0	0	0	05	01	-09	54	33	3	0	0	0	0
08	0	0	0	0	0	0	0	0	0	08	01	-08	54	33	3	0	0	0	0	0	08	01	-08	54	33	3	0	0	0	0
11	0	0	0	0	0	0	0	0	0	11	01	-07	54	33	3	0	0	0	0	0	11	01	-07	54	33	3	0	0	0	0
14	0	0	0	0	0	0	0	0	0	14	01	-06	54	33	3	0	0	0	0	0	14	01	-06	54	33	3	0	0	0	0
17	0	0	0	0	0	0	0	0	0	17	01	-05	54	33	3	0	0	0	0	0	17	01	-05	54	33	3	0	0	0	0
20	0	0	0	0	0	0	0	0	0	20	01	-04	54	33	3	0	0	0	0	0	20	01	-04	54	33	3	0	0	0	0
23	0	0	0	0	0	0	0	0	0	23	01	-03	54	33	3	0	0	0	0	0	23	01	-03	54	33	3	0	0	0	0
DAY 16										DAY 17										DAY 18										
02	0	0	0	0	0	0	0	0	0	02	01	-09	53	06	4	0	0	0	0	0	02	01	-09	53	06	4	0	0	0	0
05	0	0	0	0	0	0	0	0	0	05	01	-08	53	06	4	0	0	0	0	0	05	01	-08	53	06	4	0	0	0	0
08	0	0	0	0	0	0	0	0	0	08	01	-07	53	06	4	0	0	0	0	0	08	01	-07	53	06	4	0	0	0	0
11	0	0	0	0	0	0	0	0	0	11	01	-06	53	06	4	0	0	0	0	0	11	01	-06	53	06	4	0	0	0	0
14	0	0	0	0	0	0	0	0	0	14	01	-05	53	06	4	0	0	0	0	0	14	01	-05	53	06	4	0	0	0	0
17	0	0	0	0	0	0	0	0	0	17	01	-04	53	06	4	0	0	0	0	0	17	01	-04	53	06	4	0	0	0	0
20	0	0	0	0	0	0	0	0	0	20	01	-03	53	06	4	0	0	0	0	0	20	01	-03	53	06	4	0	0	0	0
23	0	0	0	0	0	0	0	0	0	23	01	-02	53	06	4	0	0	0	0	0	23	01	-02	53	06	4	0	0	0	0
DAY 19										DAY 20										DAY 21										
02	0	0	0	0	0	0	0	0	0	02	01	-09	53	01	4	10	25	10	0	0	02	01	-09	53	01	4	10	25	10	0
05	0	0	0	0	0	0	0	0	0	05	01	-08	53	01	4	10	25	10	0	0	05	01	-08	53	01	4	10	25	10	0
08	0	0	0	0	0	0	0	0	0	08	01	-07	53	01	4	10	25	10	0	0	08	01	-07	53	01	4	10	25	10	0
11	0	0	0	0	0	0	0	0	0	11	01	-06	53	01	4	10	25	10	0	0	11	01	-06	53	01	4	10	25	10	0
14	0	0	0	0	0	0	0	0	0	14	01	-05	53	01	4	10	25	10	0	0	14	01	-05	53	01	4	10	25	10	0
17	0	0	0	0	0	0	0	0	0	17	01	-04	53	01	4	10	25	10	0	0	17	01	-04	53	01	4	10	25	10	0
20	0	0	0	0	0	0	0	0	0	20	01	-03	53	01	4	10	25	10	0	0	20	01	-03	53	01	4	10	25	10	0
23	0	0	0	0	0	0	0	0	0	23	01	-02	53	01	4	10	25	10	0	0	23	01	-02	53	01	4	10	25	10	0
DAY 22										DAY 23										DAY 24										
02	0	0	0	0	0	0	0	0	0	02	01	-09	53	00	0	0	0	0	0	0	02	01	-09	53	00	0	0	0	0	0
05	0	0	0	0	0	0	0	0	0	05	01	-08	53	00	0	0	0	0	0	0	05	01	-08	53	00	0	0	0	0	0
08	0	0	0	0	0	0	0	0	0	08	01	-07	53	00	0	0	0	0	0	0	08	01	-07	53	00	0	0	0	0	

Figure 1 shows the Poker Flat Rocket Sounding data on temperature up to 60 km for the night of March 10, 1975. Launch of the meteorological rocket was at 1103 UT.

Examination of the ground station data shows that Ester Dome, Poker Flat and Ft. Yukon stations were clear during the launch of this rocket, thus corrections for extinction and scattering for these stations can be used which are appropriate for clear skies. However, the MSP recording cameras failed at both Ester Dome and Ft. Yukon so no photometric data are available. The general description of auroral activity can be obtained from the Poker Flat, Ester Dome and Ft. Yukon all-sky cameras.

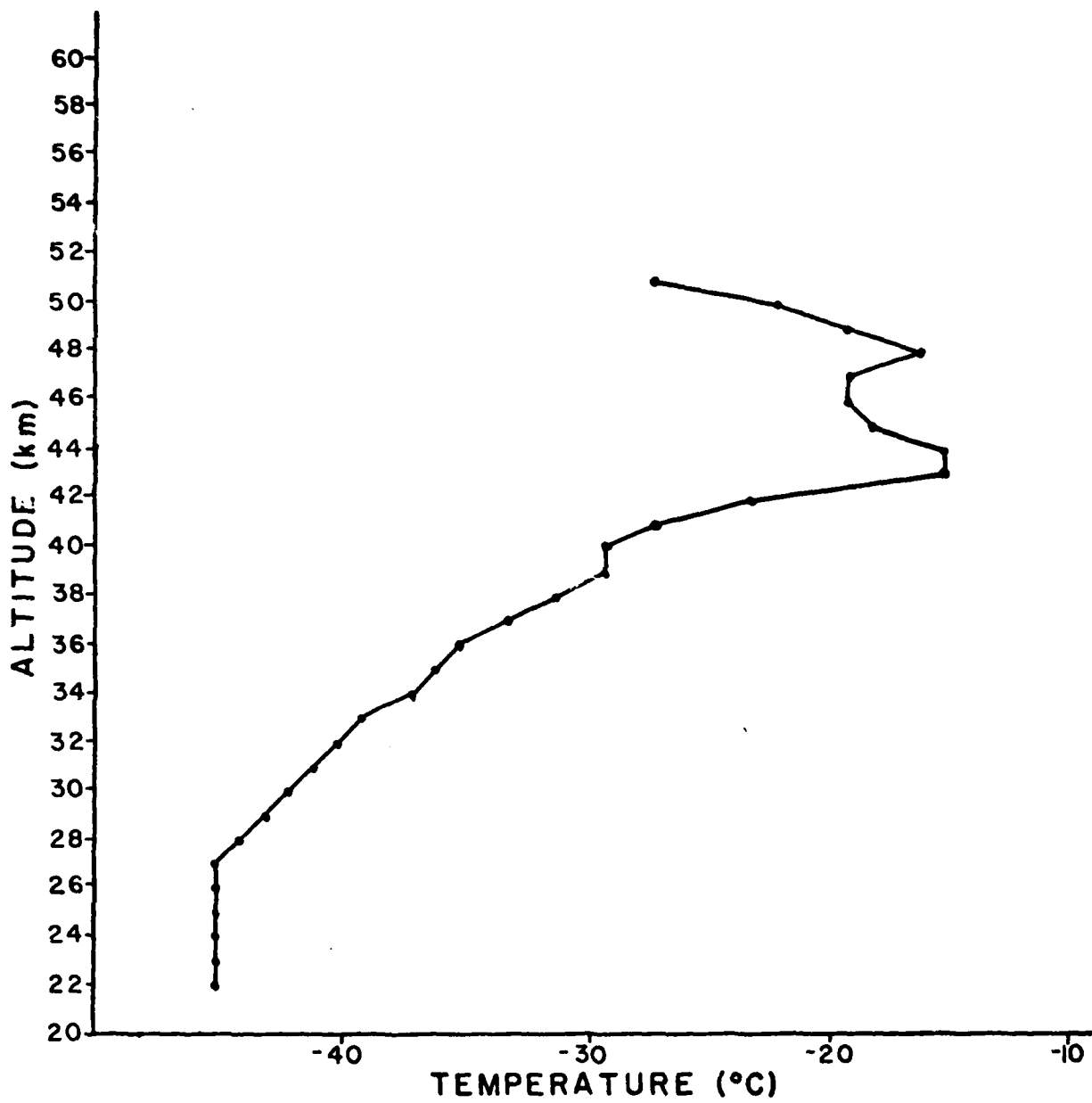


Figure 1 Temperature versus Altitude at Poker Flat

Section 3 - Solar and Lunar Data

Table 6 is a list of the geographic azimuth and elevation angles of the sun with respect to the true horizon on March 10, 1975 for Poker Flat.

TABLE 6 Solar Azimuth and Elevation

Station Location Lat = 65.13

Long = 147.48

UT Time	Azimuth	Elevation
0000	211.306	17.0572
1000	226.26	13.1275
2000	240.594	8.0858
3000	254.444	2.28356
4000	268.062	- 3.92312
5000	281.761	-10.18
6000	295.867	-16.1241
7000	310.672	-21.3736
8000	326.35	-25.5311
9000	342.863	-28.2175
10000	359.898	-29.1459
11000	16.9318	-28.207
12000	33.4413	-25.5091
13000	49.1131	-21.3378
14000	63.9096	-16.0707
15000	78.0057	-10.1049
16000	91.693	- 3.82071
17000	105.3	2.41999
18000	119.142	8.26302
19000	133.473	13.3529
20000	148.437	17.3365
21000	164.001	19.8934
22000	179.939	20.7901
23000	195.882	19.9391
24000	211.461	17.4254

Table 7 is a list of the geographic azimuth and the elevation angles of the moon with respect to the true horizon for Poker Flat during March 10, 1975.

TABLE 7 Lunar Azimuth and Elevation

Station Location Lat = 65.13

Long = 147.48

UT Time	Azimuth	Elevation
0000	240.223	.692168
1000	253.434	- 4.77787
2000	266.592	-10.65
3000	279.982	-16.6049
4000	293.916	-22.3036
5000	308.686	-27.3759
6000	324.479	-31.4237
7000	341.251	-34.0535
8000	358.642	-34.9577
9000	16.0338	-34.0104
10000	32.8048	-31.3167
11000	48.5832	-27.1679
12000	63.3175	-21.9453
13000	77.1916	-16.0384
14000	90.0003	- 9.80931
15000	103.577	- 3.5912
16000	116.72	2.30116
17000	130.185	7.55865
18000	144.138	11.8765
19000	158.618	14.9695
20000	173.513	16.6078
21000	188.575	16.6617
22000	203.502	15.1349
23000	218.048	12.1652
24000	232.099	7.99163

Section 4 - Magnetic Data and Indices

The magnetometer data from the stations listed in Table 8

TABLE 8 Location of Magnetic Observatories

Location	Geographic		Invariant		L
	Latitude	Longitude	Latitude	Longitude	
Pt. Barrow	N 71.60	W 156.4	N 66.9	W 109.35	8.47
Ft. Yukon	N 66.57	W 145.25	N 66.9	W 95.3	6.50
College	N 54.87	W 147.80	N 64.75	W 95.7	5.49

are presented in Figure 2a on the same time and magnitude scale for each of the three components of the magnetic field. The time of the rocket launch is indicated by a vertical line. Figure 2b is the magnetometer data expanded around launch time.

Figure 2c presents the magnetometer data in terms of variations of the magnitude of Z and H components with latitude. The magnetometer data shows that the westward electrojet lay between Pt. Barrow and College prior, during and after the launch. The ΔH component at College varied from -600γ at launch to -250γ at T+360. At Ft. Yukon, ΔH varied from -350γ to -950γ over the same period, indicating an intensification and poleward displacement of the westward current system. The magnitude of the current density to a first approximation (∞ sheet current) in Amp/km is the same numerical value as the H component magnitude in gamma. The actual value may be as much as two or more times that deduced from the magnitude of the magnetometer data but the temporal variation will be similar.

Figure 3 shows the total K index, planetary Kp index and DST values for UT, March 10, 1975. During the rocket flight, K_p and K were 6 and 7, respectively.

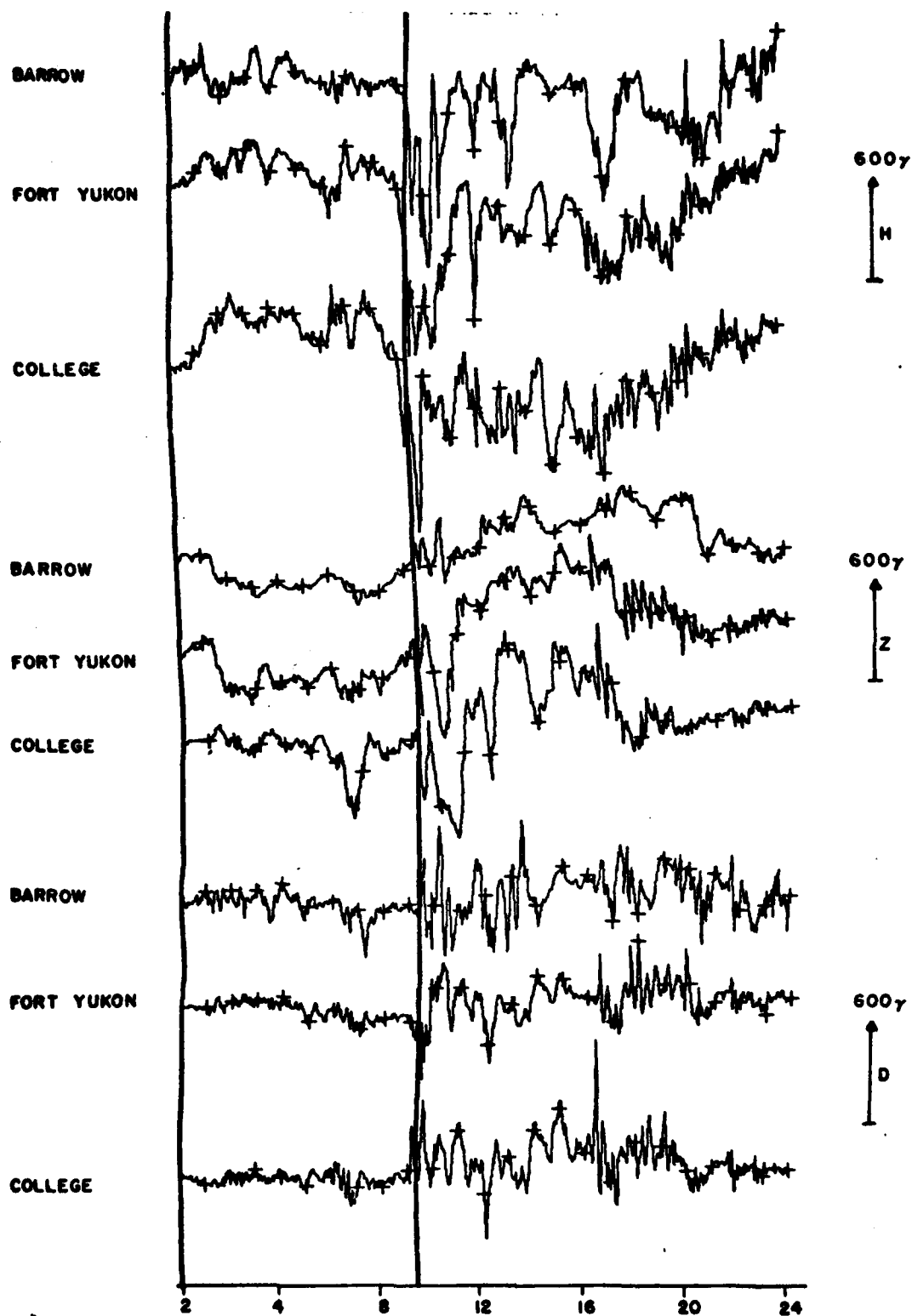


Figure 2a Magnetometer Data from Various Locations

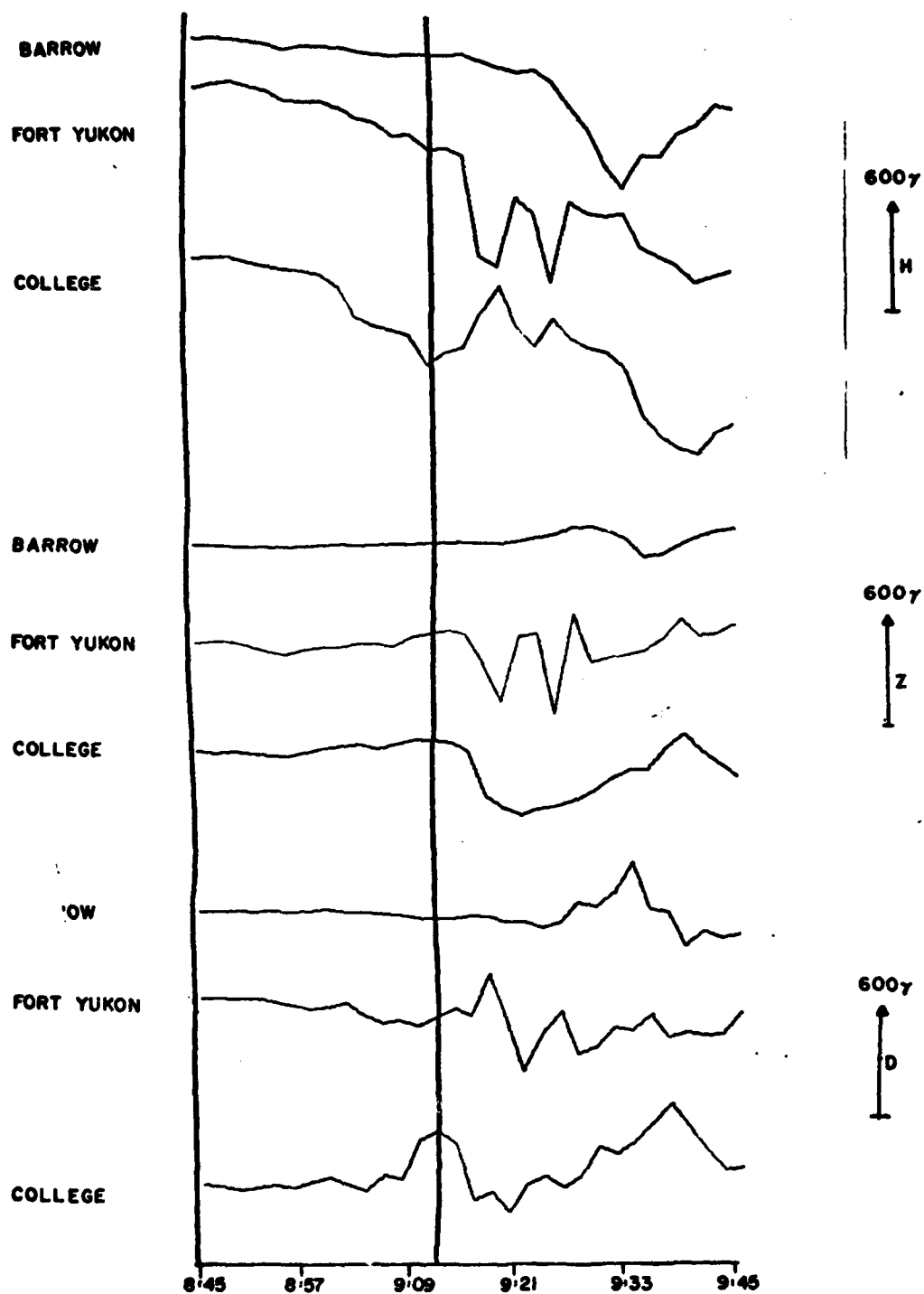


Figure 2b High Time Resolution Magnetometer Data from Various Locations.

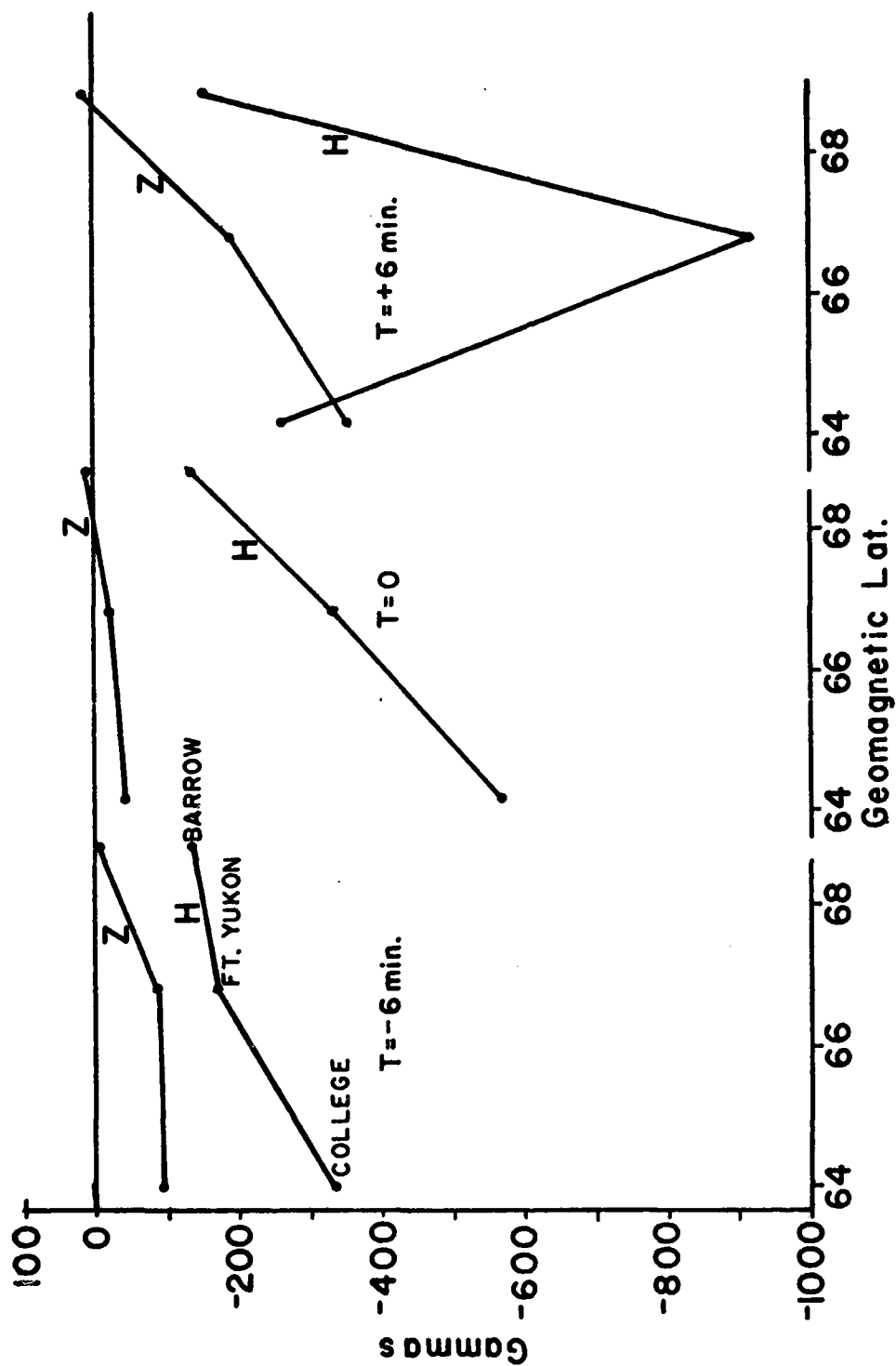


Figure 2c Variation of the Z and H Magnetic Components with Latitude

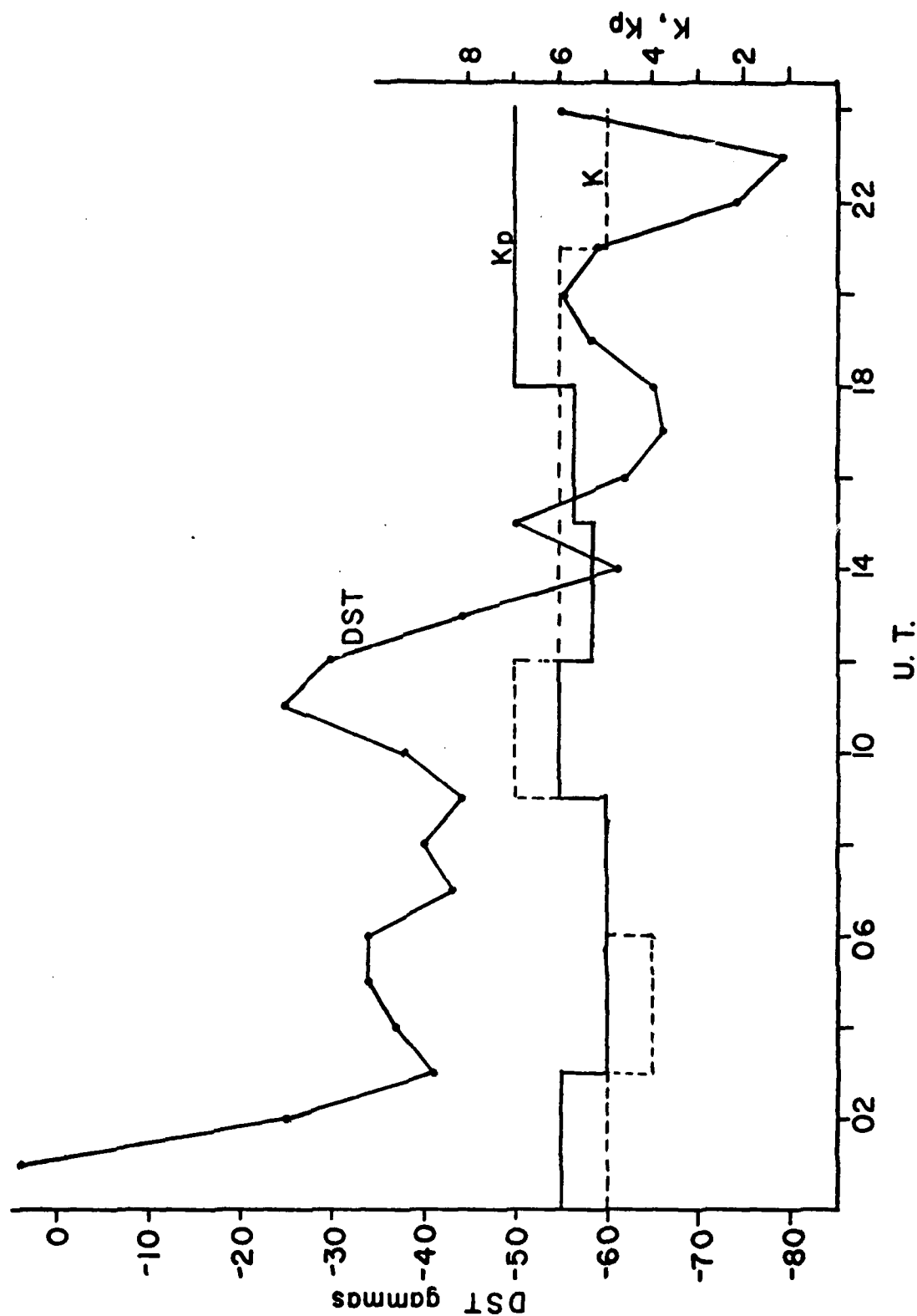


Figure 3 K, K_p , DST for March 10, 1975.

The rocket flight occurred in the initial phase of one of many auroral substorms within a large magnetospheric substorm which reached a peak intensity of -80γ in DST at 2300 UT March 10, 1975.

The DST value, as seen from Figure 3, was near -35γ during this launch, which implies using the data in Figure 4 that the cut-off trapping boundary for high energy electrons was poleward of College. The rocket probably traversed the region primarily equatorward of the high energy trapping boundary. However, since this was an active westward auroral surge, the boundary could have been in the process of moving poleward during this launch.

2030 - 2230 MLT

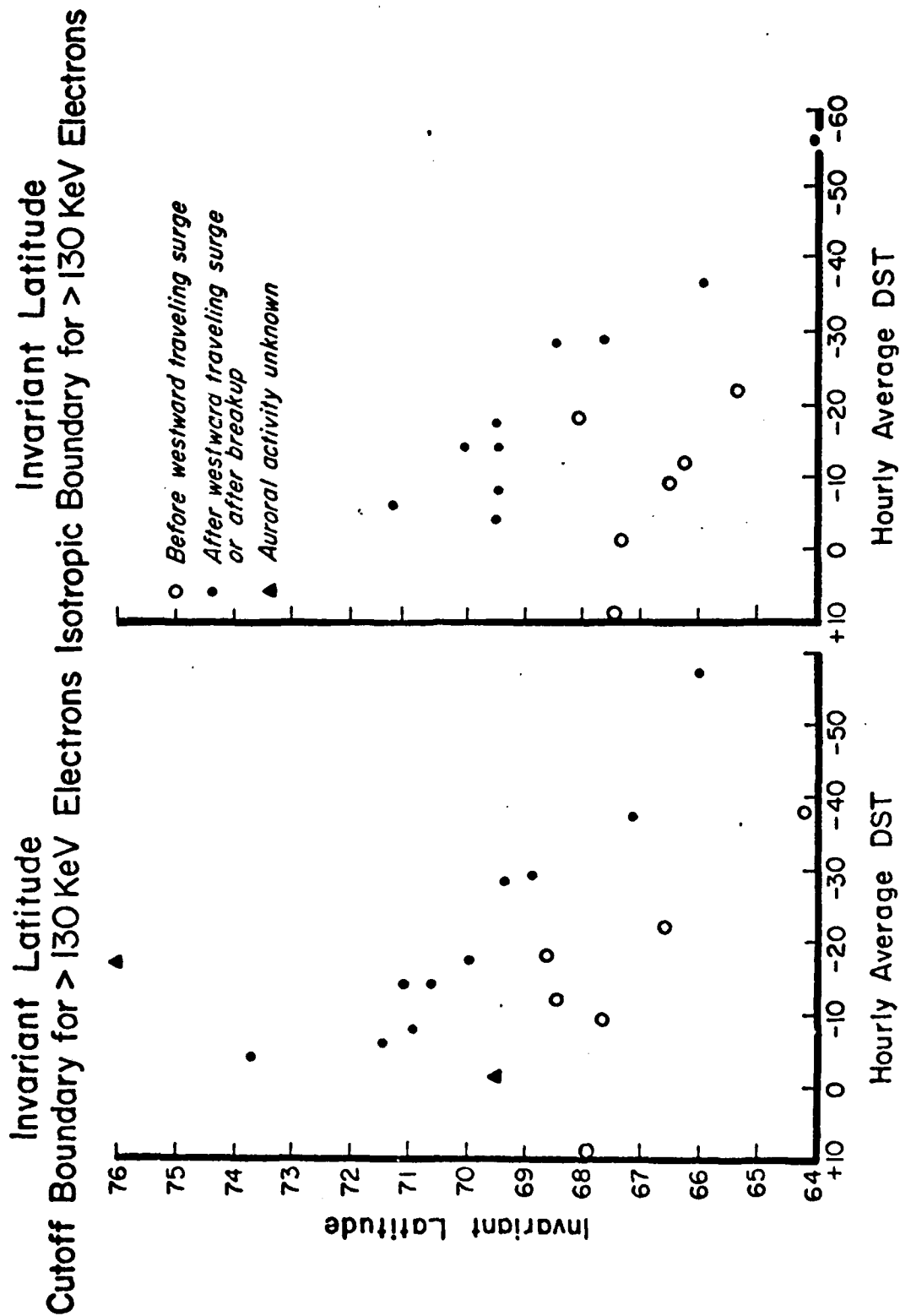


Figure 4 Latitudinal Variation in the Trapping Boundaries for > 130 keV electrons in the Evening Sector of the Auroral Oval as a Function of Dst, Before or After Substorm Activity.

Section 5 - Radar Observations

During this period in the spring of 1975 the 50 MHz NOAA radar at Anchorage was in operation on a routine basis. Resumes of their data, instrumentation, and operational details are available from NOAA in Boulder, Colorado.

In addition, data from the Chatanika Incoherent Scatter radar are also available from SRI.

Any detailed study of the rocket data should incorporate a detailed examination of the available radar data. It is particularly applicable to the spatial structure of electron density irregularities, electric fields, neutral winds, and spatial and temporal dynamics of the particle precipitation.

Section 6 - All Sky Camera Observations

Table 9 lists the stations from which either 16mm or 35mm all sky camera and other instrument data are available during the period of interest on March 10, 1975. The auroral data quality from each site depends on the cloud coverage as indicated in Section 2.

Figure 5 is a composite of 35mm all sky camera photographs for the period prior to, during and after the launch of PF-NH-89. Figure 6 shows the details of the aurora during launch.

The stations used were Ft. Yukon and Poker Flat. Time in UT as well as in seconds (or minutes) with respect to launch are indicated on each print.

From these photographs and a review of all of the data available, we describe the general auroral situation covering this rocket launch.

TABLE 9 Geophysical Instruments Operating
March 10, 1975

Chatanika

Incoh. Scat. Radar - 05:58-14:56 UT
35ASC - 05:39-14:53 UT
16ASC - patrol
Photometer - 06:00-14:53 UT

Fort Yukon

MSP - 06:04-11:45 UT
35ASC - 06:08-11:45 UT
16ASC - 02:30-13:15 UT
Riometer - Continuous
Magnetometer - Continuous

Poker Flat

TV - 09:10-09:15 UT
Magnetometer - Continuous
Riometer - Continuous

Ester Dome

MSP - 05:13-12:13 UT
35ASC - 05:28-12:14 UT
16ASC - patrol

College

Riometer - Continuous
Magnetometer - Continuous
Ebert Spectrophotometer - 08:00-15:00 UT
Zenith Photometer - 06:45-15:30 UT

MARCH 10, 1975

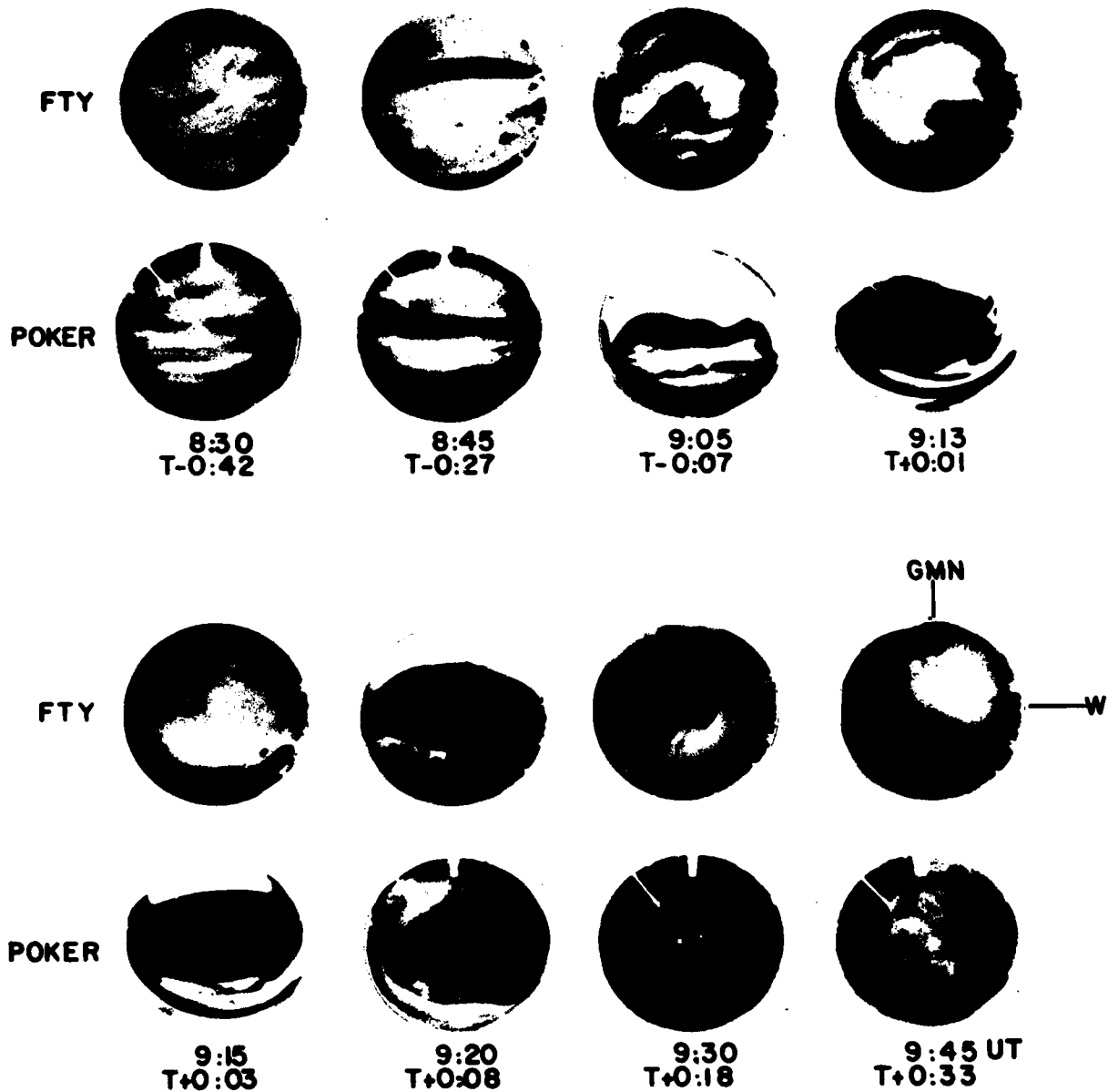


Figure 5 All Sky Camera Data Prior To, During, and After Launch (Bright Aurora are Printed Black).

MARCH 10, 1975

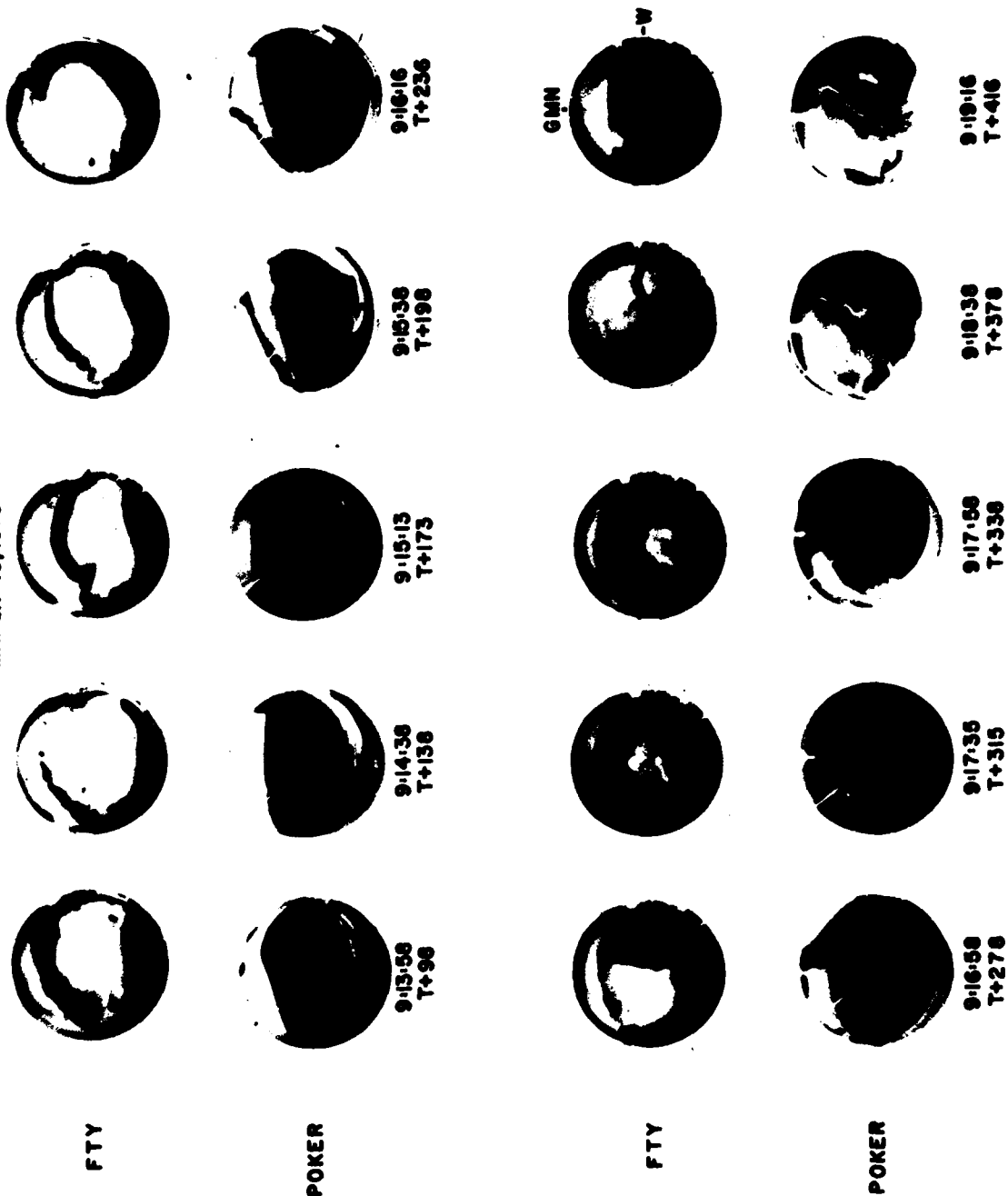


Figure 6 35mm A11 Sky Camera Data During Launch

MURPHY DOME

March 10, 1975

05:00	Dusk
05:00-06:00	Active equatorward moving arc system
06:00-06:40	Poleward expansion; very active arc system covering entire sky
06:50-08:20	Arcs on the northern horizon with diffuse aurora covering the entire sky
08:20-09:00	Arc system covering entire sky
09:04	Bright arc appears on southern horizon with very intense westward traveling intensity enhancements
09:20-11:20	Very intense diffuse aurora covering entire sky
11:20	Diffuse aurora erodes equatorward; rayed arcs appear out of the north
11:20-12:00	Active arc system covering entire sky
12:04	Westward traveling surge
12:10-dawn	Diffuse aurora

FORT YUKON

March 10, 1975

05:00	Dusk
05:00-05:40	Equatorward moving arc system
05:40-06:00	Arc system in the south
06:05-07:00	Poleward expansion; active arc system covering entire sky
07:00-07:40	Active arcs in the northern half of sky with diffuse aurora covering the entire sky
07:40-09:00	Active arc system covering entire sky
09:10	Intense westward traveling surge in the south
09:20-11:00	Intense diffuse aurora covering the entire sky
11:00-11:50	Diffuse aurora erodes equatorward; active rayed arcs appear out of the north; move rapidly to southern horizon
11:50-14:00	Poleward expansion begins; active arc system covers entire sky

Section 7 - Meridian Scanning Photometer

Meridian scanning photometers were operated by the Poker Flat Research Range at Ester Dome and Ft. Yukon during this rocket launch. However, failure of the recording camera at both sites provides no usable photometric data during this launch.

Section 8 - Television Coverage

Television data from Ester Dome and Poker Flat were obtained during this rocket launch.

Section 9 - Riometer Data

Riometers are operated at Ft. Yukon, Poker Flat and College.

Absorption is measured at 30 MHz. Figure 7 shows the records from 8:00 to 12:00 UT on March 10, 1975 for Ft. Yukon and Poker Flat. There was absorption greater than 5 db at both stations during the time interval of interest which indicates that high energy particles were precipitating during this rocket flight. The exact values of absorption are accurate to ± 2 db for this level of activity.

MARCH 10, 1975

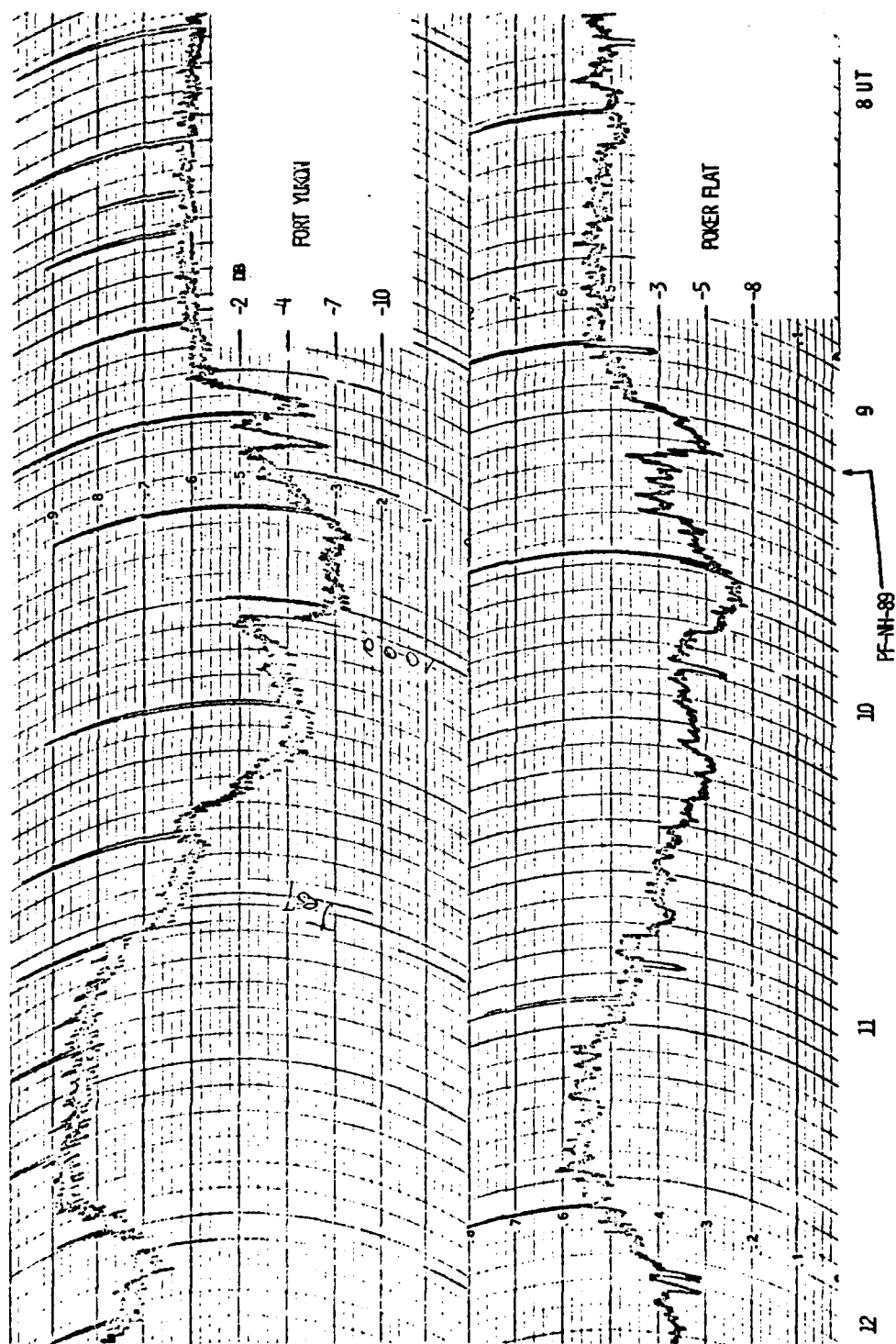


Figure 7 Riometer Absorption from Poker Flat and Ft. Yukon

Section 10 - Ionosonde Data

The ionosonde at College operates between .5 and 20 MHz at vertical incidence. It requires approximately 30 seconds to sweep over the complete frequency range and is normally programmed to operate once every 15 minutes, on the minute. Data for the 3 periods closest to launch are presented here. The earliest trace shows evidence of a thick E layer with peak electron density $\sim 7.5 \times 10^5$ electrons/cm³ with the presence of oblique echoes from scattering due to rayed structures. The middle trace shows a thinner E-layer with enhanced lower E-layer absorption, but with similar electron densities and oblique echoes to the earlier trace. The lower trace shows a thicker E-layer, but little change in peak electron density or absorption.

MARCH 10, 1975

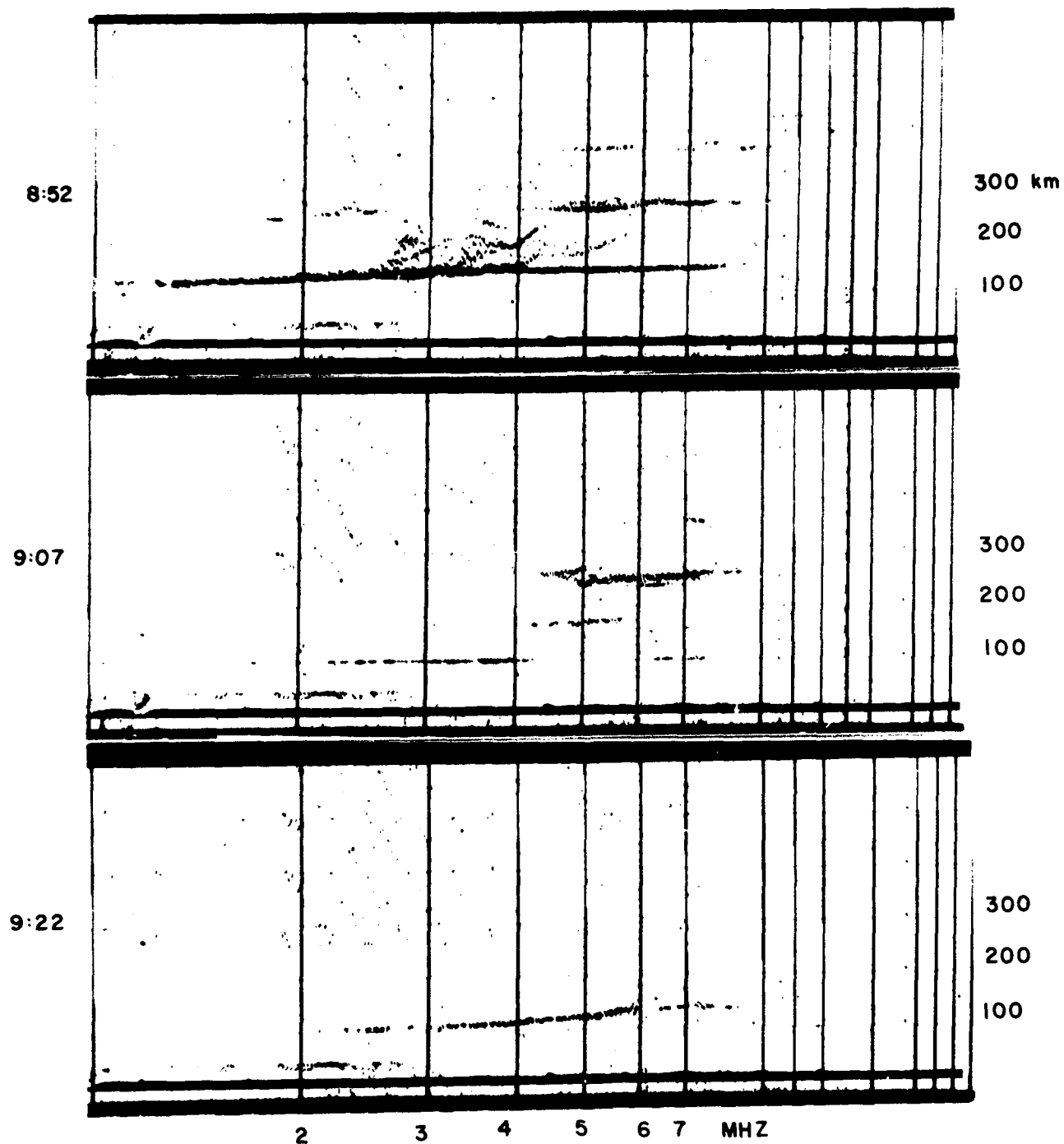


Figure 8 Ionosonde Data from College.

Section 11 - DMSP Satellite Photographic Data

The Air Force weather DMSP satellites record auroral activity on nighttime passes over the auroral zone. We have included in Figure 9 the closest satellite pass to the launch of Rocket PF-NH-89. The aurora seen on this photograph covers the period 0855 UT to 0857 UT. A map of Alaska is superimposed on the satellite photograph for orientation purposes. The satellite orbit passed along the center of the original photograph through Point Barrow (BRW). The rocket launch occurred approximately 16 minutes after the satellite had passed over the same latitude, thus these DMSP data can be used to help describe the situation prior to launch.



Figure 9 DMSP Satellite Photograph at 08:55-08:57 UT, March 10, 1975

References

Akasofu, S.-I., Polar and Magnetospheric Substorms, D. Reidel Publishing Company, Dordrecht, Holland, 1968.